

004/2016

Maximum : 100 marks

Time : 1 hour and 15 minutes

- An ideal gas of mass  $m$  and temperature  $T_1$  undergoes a reversible isothermal process from an initial pressure  $p_1$  to final pressure  $p_2$ . The heat loss during the process is  $Q$ . The entropy change of the gas is :  
(A)  $mR \ln(p_2 / p_1)$  (B)  $mR \ln(p_1 / p_2)$   
(C)  $mR T_1$  (D) zero
- Heat and work are :  
(A) Path functions (B) Intensive properties  
(C) Point functions (D) None of the above
- If a closed system is undergoing an irreversible process, the entropy of the system :  
(A) Must decrease (B) Zero  
(C) Must increase (D) Remain constant
- A gas contained in a cylinder is compressed; the work required for compression is 3000 kJ. During the process, heat interaction of 500 kJ causes the surroundings to be heated. The changes in internal energy of the gas during the process is :  
(A) 500 kJ (B) -3500 kJ  
(C) +3500 kJ (D) 2500 kJ
- A 2000 W, 25 liters water heater is switched on for 30 minutes. The heat capacity  $c_p$  for water is 4.2 kJ/kgK. Assuming all the electrical energy has gone for heating the water, increase of the water temperature in degree centigrade is :  
(A) 10.7 (B) 34.3  
(C) 24.3 (D) 44.5
- A positive value of Joule-Thomson coefficient of a fluid means :  
(A) Temperature drops during throttling  
(B) Temperature remains constant  
(C) Temperature rises during throttling  
(D) None of the above

7. Dew point temperature is the temperature at which condensation begins when the air is cooled at constant :
- (A) Temperature (B) Entropy  
(C) Pressure (D) Enthalpy and Volume
8. A sample of ambient air (at 35°C, 75% relative humidity,  $p_o = 0.042$  bar, and standard atmosphere pressure), the amount of moisture in kg per kg of dry air will be approximately :
- (A) 0.2 (B) 0.27  
(C) 0.027 (D) 0.85
9. Usually in the window air conditioner, the expansion device used is :
- (A) Capillary tube (B) Thermostatic expansion valve  
(C) Gate valve (D) None of the above
- 10.— For air with a relative humidity of 80% :
- (A) Dry bulb temperature is less than the wet bulb temperature  
(B) Dew point temperature is less than wet bulb temperature  
(C) Dew point and wet bulb temperature are equal  
(D) None of the above
11. The density of water at one atmosphere pressure and 30°C is approximately :
- (A) 1.0 kg/m<sup>3</sup> (B) 100.0 kg/m<sup>3</sup>  
(C) 500.0 kg/m<sup>3</sup> (D) 1000.0 kg/m<sup>3</sup>
12. Oil flows through a 200 mm diameter horizontal pipe with friction factor  $f = 0.022$  and length 500 m. The volumetric flow rate is 0.2 m<sup>3</sup>/s. The head loss due to friction in meters is (assume  $g = 9.8$  m/s<sup>2</sup>) :
- (A) 12.4 m (B) 1010.1 m  
(C) 522.7 m (D) 116.3 m
13. For the stability of a floating body, under the influence of gravity alone, which of the following is TRUE?
- (A) Metacenter should be below centre of gravity  
(B) Metacenter should be above centre of gravity  
(C) Metacenter and centre of gravity must lie on the same horizontal line  
(D) None of the above
14. A phenomenon is modeled using  $n$  dimensional variables with  $m$  primary dimensions. The number of non-dimensional variables is :
- (A)  $n - m$  (B)  $n$   
(C)  $nm$  (D)  $n + m$

15. The continuity equation is derived based on fundamental principle of :  
(A) Law of conservation of energy  
(B) Law of conservation of momentum  
(C) Law of conservation of mass  
(D) All of the above
16. For a Newtonian fluid :  
(A) Shear stress is proportional to acceleration  
(B) Rate of shear stress is proportional to shear strain  
(C) Shear stress is proportional to density  
(D) Shear stress is proportional to rate of shear strain
17. A venturimeter is used to measure :  
(A) Density  
(B) Pressure  
(C) Discharge  
(D) None of the above
18. The SI unit of kinematic viscosity is :  
(A)  $m^2/s$   
(B)  $kg/m$   
(C)  $m/s^2$   
(D)  $m/s$
19. A static fluid can have :  
(A) Positive normal and shear stress  
(B) Negative normal stress and Negative shear stress  
(C) Zero normal stress and zero shear stress  
(D) Positive normal stress and zero shear stress
20. For a laminar flow through a circular pipe, Reynolds number will be :  
(A) More than 5000  
(B) More than 4500  
(C) Less than 2000  
(D) None of the above
21. Two diffuse gray parallel plates, separated by distance, have surface temperatures of  $127^\circ C$  and  $27^\circ C$ . If the emissivity of the surface are 0.8 and the Stefan-Boltzmann constant is  $5.67 \times 10^{-8} W/m^2 K^4$ , the net radiation heat exchanges rate in  $W/m^2$  between the two plates is :  
(A) 0.6  
(B) 66.1  
(C) 661  
(D) 6600
22. In a condenser of a power plant, the steam condenses at temperatures of  $50^\circ C$ . The cooling water enters at  $20^\circ C$  and leaves at  $35^\circ C$ . The logarithmic mean temperature difference (LMTD) of the condenser is :  
(A)  $11.6^\circ C$   
(B)  $26.6^\circ C$   
(C)  $0^\circ C$   
(D)  $21.6^\circ C$

23. A fin efficiency is defined as :
- (A) Actual heat transfer rate from the fin/Ideal heat transfer rate from the fin
  - (B) Ideal heat transfer rate from the fin/Actual heat transfer rate from the fin
  - (C) Heat transfer rate from the fin/Heat transfer without fin
  - (D) All of the above
24. Thermal conductivity of pure Copper at room temperature is approximately :
- (A) 38 W/m.K
  - (B) 9 W/m.K
  - (C) 398 W/m.K
  - (D) 3285 W/m.K
25. Critical radius of insulation for cylindrical body is (if  $k$  is thermal conductivity of insulation and  $h$  is convection heat transfer coefficient) :
- (A)  $h/k$
  - (B)  $k/h$
  - (C)  $2k/h$
  - (D)  $2h/k$
26. The Log Mean Temperature Difference (LMTD) of a double pipe heat exchanger will be usually :
- (A) Greater for parallel flow heat exchanger than for counter flow heat exchanger
  - (B) Greater for counter flow heat exchanger than for parallel flow heat exchanger
  - (C) Same for both parallel and counter flow heat exchangers
  - (D) All of the above
27. The crank radius of a single-cylinder I.C. engine is 50 mm and the diameter of the cylinder is 70 mm. The swept volume of the cylinder in  $\text{cm}^3$  is :
- (A) 38
  - (B) 385
  - (C) 3021
  - (D) 3603
28. In an air-standard Otto-cycle, the compression ratio is 10. The condition at the beginning of the compression process is 100 kPa and 300K. Heat added at constant volume is 1500 kJ/kg, while 700 kJ/kg of heat is rejected during the other constant volume process in the cycle. Specific gas constant for air = 0.287 kJ/kgK. The mean effective pressure (in kPa) of the cycle is :
- (A) 1032
  - (B) 318
  - (C) 1515
  - (D) 403
29. Which one of the following is a necessary assumption for the air-standard Otto cycle?
- (A) All processes are adiabatic
  - (B) Intake and exhaust processes are constant pressure heat rejection processes
  - (C) The combustion process is isothermal heat addition process
  - (D) The working fluid is an ideal gas with constant specific heats

30. The stroke and bore of a four stroke SI engine are 250 mm and 200 mm respectively. The clearance volume is  $0.001 \text{ m}^3$ . If the specific heat ratio is 1.4, the air-standard cycle efficiency of the engine is :
- (A) 41.40% (B) 46.10%  
(C) 58.20% (D) 82.80%
31. A Carnot cycle is having an efficiency of 0.78. If the temperature of the high temperature reservoir is 1241 K, what is the temperature of low temperature reservoir?
- (A)  $0^\circ\text{C}$  (B) 0 K  
(C)  $273^\circ\text{C}$  (D) 100 K
32. A solid circular shaft transmits a torque of 80 Nm. If the allowable shear stress of the material is 150 MPa, assuming a factor of safety of 2, the minimum allowable design diameter in mm is :
- (A) 12 mm (B) 8 mm  
(C) 82 mm (D) 18 mm
33. A clutch has outer and inner diameters 10 cm and 4 cm respectively. Assuming a uniform pressure of  $2 \times 10^6 \text{ Pa}$  and coefficient of friction of liner material is 0.4, the torque carrying capacity of the clutch is :
- (A) 118 Nm (B) 196 Nm  
(C) 562 Nm (D) 390 Nm
34. The most appropriate description of a Helical gear is :
- (A) Axes parallel and teeth are inclined to the axis  
(B) Axes non parallel and non-intersecting  
(C) Axes are perpendicular and used for large speed reduction  
(D) None of the above
35. For Rack and Pinion :
- (A) Axes non parallel and non-intersecting  
(B) Axes parallel and one of the gears has infinite radius  
(C) Any of the above  
(D) None of the above
36. Twenty degree full depth involute profiled 21 tooth pinion and 39 tooth gear are in mesh. If the module is 5 mm, the centre distance between the gear pair will be :
- (A) 140 mm (B) 250 mm  
(C) 280 mm (D) 150 mm

37. Two mating spur gears have 40 and 120 teeth respectively. The pinion rotates at 900 rpm and transmits a torque of 25 Nm. The torque transmitted by the gear is :
- (A) 75 Nm (B) 750 Nm  
(C) 40 Nm (D) 400 Nm
38. The coupling used to connect two shafts with large angular misalignment is :
- (A) Flange coupling (B) Oldham's coupling  
(C) Hooke's joint (D) None of the above
39. When a shaft is subjected to repeated stress; then the shaft will be designed for :
- (A) Maximum compressive stress (static) (B) Maximum tensile (static)  
(C) Maximum bending moment (static) (D) Fatigue loading
40. Large speed reductions (greater than 20) in one stage of a gear train are possible through :
- (A) Spur gearing (B) Worm gearing  
(C) Bevel gearing (D) All of the above
41. Which of the following aspect is concerned with working conditions and amenities such as canteens, crèches, housing, transport, etc?
- (A) Industrial Relations Aspect (B) Labor Aspect  
(C) Welfare Aspect (D) Monetary Aspect
42. In the job designing concept, BPR stands for :
- (A) Business Process Resourcing (B) Business Process Reengineering  
(C) Business Process Reporting (D) Business Process Remodeling
43. The vertical expansion of job by increasing the amount of worker's responsibilities associated with the position is called :
- (A) Job Rotation (B) Job Simplification  
(C) Job Enrichment (D) Job Enlargement
44. Which of the following is not an external source of recruitment?
- (A) Employment Exchanges (B) Data Banks  
(C) Labor Contractors (D) Transfer
45. \_\_\_\_\_ test is designed to find out how efficiently and swiftly an applicant uses his hands, fingers, eyes or other parts of body.
- (A) Aptitude Test (B) Achievement Test  
(C) Interest Test (D) Dexterity Test

46. Who quotes "Induction is the welcoming process to make the new employee feel at home and generate in him a feeling of belongingness to the organization"?
- (A) Michael Armstrong (B) Edwin B. Flippo  
(C) Peter F. Drucker (D) Abraham Maslow
47. The tendency to evaluate a person on the basis of one trait or characteristic is the Phenomenon of :
- (A) Central Tendency (B) Leniency  
(C) Halo Error (D) Similarity Error
48. A situation in which employees perceive too narrow a difference between their own pay and that of their colleagues :
- (A) Pay secrecy (B) Pay Compression  
(C) Pay Security (D) None of these
49. Under which system of payment quality of goods can be ensured?
- (A) Piece Rate System (B) Time Rate System  
(C) Incentives (D) None of these
50. Which of the following marketing concept is based on the development, design, and implementation of marketing programmes, processes and activities that recognizes their breadth and interdependencies :
- (A) Relationship Marketing Concept (B) Niche Marketing Concept  
(C) Holistic Marketing Concept (D) Service Marketing Concept
51. Which of the following is a communication model that is used to improve understanding between individuals?
- (A) Kaizen (B) Johari Window  
(C) Six Sigma (D) Hot Stove Rule
52. A tool for identifying key activities that create value and costs in a specific business is called :
- (A) Supply Chain (B) Value Chain  
(C) Market Chain (D) None of these
53. Who propounded two factor theory of motivation?
- (A) Abraham Maslow (B) Herzberg  
(C) David C. Mclelland (D) Mc Gregor
54. The term 'Gherao' means :
- (A) to prevent (B) to surround  
(C) to block (D) to disagree